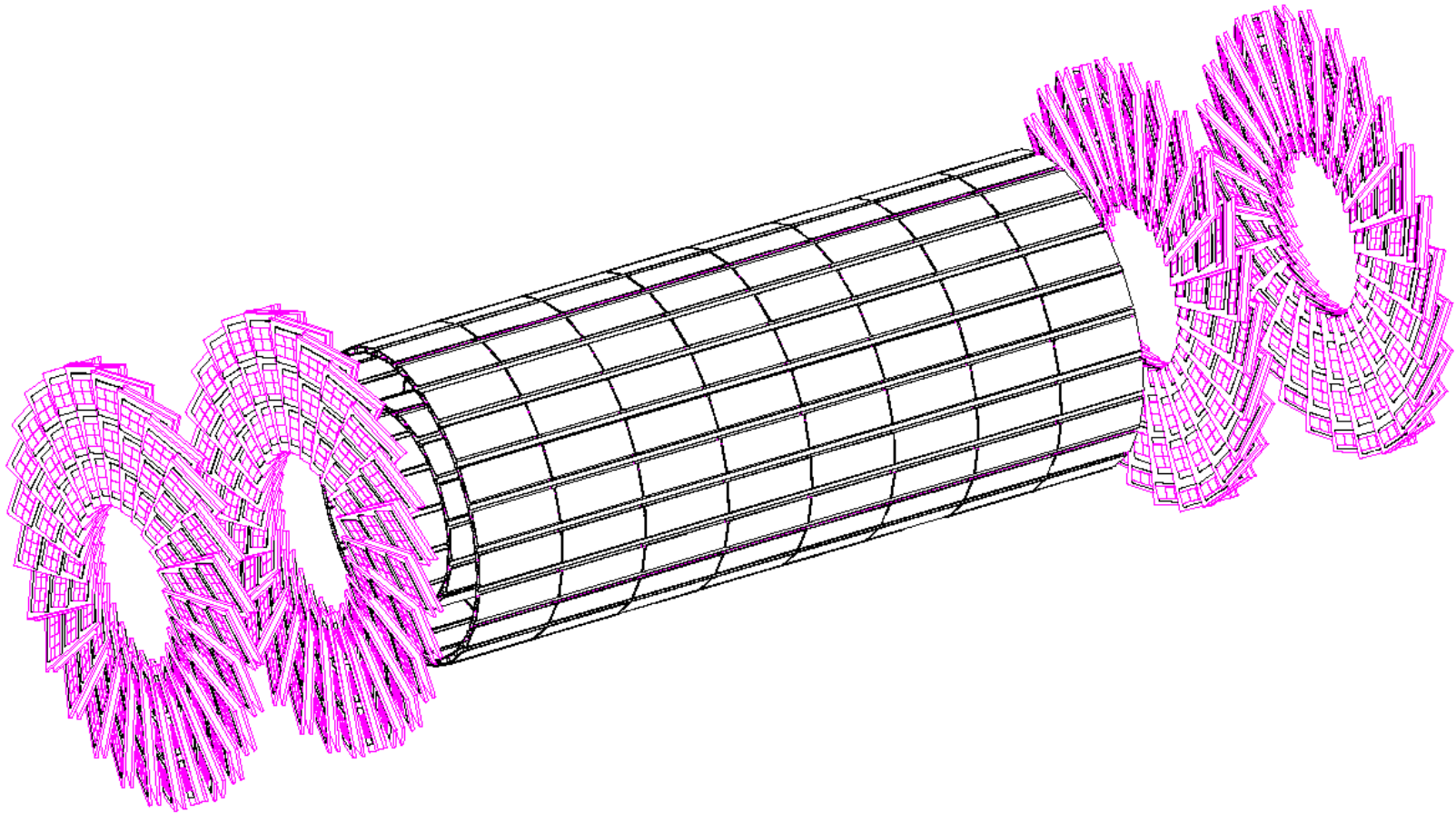


Some Pixel Database Issues

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CMS Pixel Detector



Detector Dimensions

Barrels

- Total 3 – initially 2
- $z = \pm 266.6 \text{ mm}$
- $r = 41.05 \text{ mm} - 104.26 \text{ mm}$

Forward Disks

- 4 Disks (current), 2 additional later
- $z = \pm 34.5 \text{ cm}, \pm 46.5 \text{ cm}$
- $r_{\min} = 6 \text{ cm}$
- $r_{\max} = 15 \text{ cm}$

Total Coverage: $-2.52 < \eta < 2.52$

What are we dealing with?

- **Pixel size:** 100 x 150 μm (0.25 μm CMOS)
- **Chip readout:** 4160 pixels
(52 cols x 80 rows)
- **Total ROCs:** 15,840 (3 barrels, 4 disks)
17,500 (3 barrels, 6 disks)
- **Total Pixels** ~ 66M (3 barrels, 4 disks)
~ 73M (3 barrels, 6 disks)

Pixel Databases

- **Construction Database**
- **Equipment Management Database**
- **Configuration Database**
- **Conditions Database**

Construction Database

- Track every component & history during production
- Aid in future troubleshooting
- Several institutions involved in fabrication
- Need secure access to database from remote location

Construction Database

- **Readout chip (example)**
 - wafer serial number bonded sensor
 - test parameters
 - module number
 - Cable connected
 - detector location
 - DAC settings (?)
- **Many components**
 - Sensors
 - Readout chips
 - Electronic components (**VHDI, HDI, FEC, FED, TBM, etc**)
 - Cables
 - Cooling
 - Support structures

Equipment Management Database

- **Construction Database will evolve into Equipment Management Database**
- **Keep track of the smallest replaceable unit in the detector**
- **Required by French INB to track all components exposed to radiation**

Configuration Database

- Stores entities necessary to start up a run
- Should be accessible to DAQ, DCS (controls), and the detector (for monitoring) systems
- Potential of being very large
- Information to bring each individual pixel and readout chip to operational state
- Information for other electronic components

Configuration Database

- **Per Pixel Database entry (current estimate): 29 bytes**
 - Detector ID (barrel, B+ disks, or B- disks): 1 byte
 - Module #: 4 bytes
 - ROC ID: 4 bytes
 - Pixel ID
 - double column #: 1 byte
 - row #: 1 byte
 - Thresholds (trim bits): 1 byte
 - Mask bit: 1 byte
 - Pedestals: 4 bytes
 - Gain: 4 bytes
 - Efficiencies: 4 bytes
 - Average rates: 4 bytes

Configuration Database

- **Storage for 1 calibration run (32 bytes/entry)**
 - 2 GB (66M pixels)
 - 2.4 GB (73M pixels)
- **Per readout chip database entry (current estimate): 40 bytes**
 - 28 DAC settings: 28 bytes (1 byte per DAC)
 - 2 Control registers: 8 bytes (4 bytes per register)
 - Temperature: 4 bytes
- **Total per data collection**
 - 634 KB (4 disks)
 - 700 KB (6 disks)

Configuration Database

- Problem is not with storage size alone
- There is also the overhead incurred in
 - Data retrieval from the database
 - Data transfer
 - Data distribution to multiple locations (FEC, FED, monitor, etc.)
 - Data transfer to readout chips
- Other info
 - Cooling monitor
 - Hot pixel monitor
- Complex database. Implementation will not be easy

Conditions Database

- Offline
- Calibration data
- Don't know much about it yet